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BULLETIN

OF THE

AMERICAN PHYSICAL SOCIETY

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PROGRAMME OF THE

NEW YORK MEETING

AT

COLUMBIA UNIVERSITY

NEW YORK CITY

January 19–20, 1945

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BULLETIN

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AMERICAN PHYSICAL SOCIETY

NEW YORK MEETING, JANUARY 19–20, 1945

THE **265th meeting of the American Physical Society,** which is the **"1944 Annual Meeting,"** is to be held—conformably with the wartime policy established two years ago—at Columbia University in New York City on Friday and Saturday, January 19 and 20, 1945. The American Association of Physics Teachers (AAPT) holds meetings concurrent with ours. The registration desks for the two Societies will be located in the Pupin Physics Laboratories, in which building will also be held all of our sessions excepting that of Saturday morning.

Hotel. The Hotel Pennsylvania (across the street from Pennsylvania Station) offers us single rooms at $3.85 and up, double rooms at $5.50 and up, double rooms with twin beds at $6.60 and up. Reservations should be made *immediately;* in this year more than ever before, anyone arriving without a confirmed reservation takes a serious risk of not finding any room at all. Members should mention in writing that they belong to the American Physical Society. Reminder is given that members expecting to arrive in the evening must so notify the hotel when they ask for their reservations.

Masculine members who apply too late to the Pennsylvania may perhaps find simple quarters in the dormitories of Columbia University: request should be made of the Director of University Residence Halls, 125 Livingston Hall, Columbia University, New York 27, N. Y.

How to reach Columbia University (reprinted by request). To go from the Hotel Pennsylvania to the Pupin Laboratories proceed to the IRT subway (under the front entrance of the hotel) and take an uptown train marked either "B'way-7th Ave. Express—Van Cortlandt Park" or "B'way-7th Ave. Local—137th St. Broadway." Get off at 116th street, and walk three blocks north to 119th street, turning there to the right through the campus gates. Allow 35 minutes. If on emerging from the subway at 116th street you find yourself on Lenox Avenue, you have failed to follow the foregoing instructions, and should take the first train in the reverse direction back to 96th street and try again (it would, however, be quicker to take a taxi, if you can find one).

The **Business Meeting** of the Society will commence on Saturday morning at ten in the McMillin Theatre, at the northeast corner of Broadway and 116th street, opposite the subway station.

The **retiring presidential address of President Dempster,** "Twenty-Five Years of Mass-Spectroscopy," will follow upon the Business Meeting, and will in turn be followed by the two formal annual events of the AAPT; the award of the **Oersted Medal** to a distinguished teacher of physics, and the delivery of the (fourth) **Richtmyer Lecture.**

A **Symposium on the Physics of the Solid State** has been arranged, at the invitation of the Council, by a group of six members of the Society: S. Dushman, T. A. Read, F. Seitz, W. Shockley, S. Siegel, and R. Smoluchowski. The

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fourteen papers are distributed in three sessions all to be held in Pupin 301, on the morning and afternoon of Friday and on the afternoon of Saturday. This important event may prove to be the prelude to the establishment of a Division of the Physics of the Solid State in the American Physical Society. Time for a discussion of this step has been provided in the schedule of the Symposium, beginning at five P.M. on Friday.

Sessions for other invited papers and for contributed papers will be held in Pupin 428 on Friday morning (beginning at 9:30!) and afternoon.

The **dinner** of the two societies will be held on Friday evening at six at the Men's Faculty Club, 400 West 117th street (east of the campus) at a price of $1.75. Advance reservation, preferably by use of the form printed upon the inside back cover page of this Bulletin, is urgently advised. Places at the dinner may not even be available to those who omit to make advance reservation or leave it to the last moment. Informal attire is recommended.

The **Council of the American Physical Society** will meet at 8 P.M. on Thursday in the Men's Faculty Club. Members thereof will be welcome at dinner in the Club at 6:45.

General Rules Relating to Papers

By vote of the Society on December 27, 1940, no paper may be accepted for presentation at any meeting of the Society unless the title and an abstract of the paper are delivered to the office of the American Physical Society not later than the closing date stated in the printed call for the meeting.

The time allowed for the oral presentation of a contributed paper is ten minutes at most.

When two or more papers are contributed by the same member, all but one are placed on the "supplementary programme." (A paper by two or more members is credited to the one first named in its title.) For each paper on this programme the Secretary indicates a session at which it may be presented. The presiding officer at this session may call for it when the other papers are completed, may require that it be given in shortened form, or may read it by title.

Titles and abstracts of the papers to be presented are given in the following pages. Proofs of these abstracts have not been submitted to the authors. After submission of proof the abstracts will be published in an early number of *The Physical Review*.

KARL K. DARROW, *Secretary*,
American Physical Society,
Columbia University, New York 27, New York

PROGRAMME

FRIDAY MORNING AT 9:30

Pupin 428

Contributed Papers

D1. Metallurgical Transformations in Metal Surfaces under Conditions of Boundary Lubrication. B. W. SAKMANN, *Massachusetts Institute of Technology.*—The surfaces of steel flats run-in on rotating cast-iron disks under lubricated conditions may show metallurgical transformations. The transformed material is considerably harder than the underlying steel and protrudes over initially smooth surfaces by several microns. The experiments which were made with the aim of identifying the nature of the transformations include etching tests, microhardness tests, x-ray diffraction pictures, different heat treatments of the transformations, and inspection of the microstructure of the transformed material and the transition region between the transformation and the bulk material of the steel. The results of some of the tests seem to indicate that one is dealing with a carbide rich phase. From the value of the friction force on the stationary flat and the linear velocity of the rotating disk it is possible to determine the heat produced during the running-in process. Heat conductivity calculations give an estimate of the temperature reached. The effect of different heat treatments on the etching characteristics of the transition reaction between transformed material and bulk steel confirms this estimate of the temperature.

D2. The Mechanics of the Metal Cutting Process. III. Plasticity Conditions in Oblique Cutting. M. EUGENE MERCHANT, *Cincinnati Milling Machine Company.*—Plasticity conditions have been investigated for the process of oblique cutting, which process was previously defined and analyzed in Part II of this series. The same simple case has been considered as that which yielded such a good approximation to experiment in the case of simple (orthogonal) cutting, described in Part I of this series—namely, the assumption that the shear strength of the material being cut is a function of the normal stress acting on the plane of shear. The application of the principle of minimum energy then results in a very simple major plasticity condition for the case of oblique cutting, also, namely, $2\phi' + \sigma' = C$, where ϕ' and σ' are angles defining the geometry of the process of chip formation and its accompanying force system, and C is a constant derivable from the relationship found between shear strength and normal stress for the particular material being cut. This relationship is found to be in good agreement with experiment.

D3. Piezoelectric Studies of Primary Phosphates and Arsenates. HANS JAFFE, *The Brush Development Company, Cleveland, Ohio.*—The piezoelectric moduli of a group of isomorphous phosphates and arsenates were determined at 27°C by measuring the shearing strain of crystal plates subjected to 60-cycle voltage with a piezoelectric pick-up. The crystals belong to class V_d characterized by two piezoelectric moduli $d_{14} = d_{25}$, and d_{36}. In some cases the associated short-circuit elastic compliances s were found from the harmonic series of resonances obtained by applying electric fields parallel to one of the longer edges of plates cut parallel to the symmetry axes. The table gives the results in 10^{-12} m/volt and 10^{-12} m²/newton, along with the "free" relative dielectric constants K and coupling coefficients k calculated from the preceding columns. All dielectric constants and the modulus d_{36} of KH_2PO_4 were published previously by Swiss authors; the bracketed values are taken from these sources.

	d_{14}	s_{44}	K_a	k_{14}	d_{36}	s_{66}	K_c	k_{36}
KH_2PO_4	1.3		(48)		21	155	(26)	.11
$NH_4H_2PO_4$	1.5	116	56	.006	50	166	15.3	.33
KH_2AsO_4	21		(62)		22		(22)	
$NH_4H_2AsO_4$	29	136	(125)	.075	31	156	(12)	.24

D4. Resistance of Carbon to Carbon Contact. W. B. PIETENPOL AND F. C. WALZ, *University of Colorado.*—The contact resistance of plane carbon surfaces was measured at constant temperature over a pressure range of 78.88 to 31803.6 grams per sq. cm. A potentiometer method was used with current approximately 0.1 ampere. Corrections were made for the resistance of solid carbon and resistances were measured to four significant figures with pressures determined to 0.1 gram per sq. cm. After pressures are increased the contact resistances decrease with time and at low pressures do not reach equilibrium values until approximately 24 hours have elapsed. When pressures are decreased contact resistances increase with smaller time lags. The equilibrium contact resistance-pressure curves are in good agreement with the theory summarized by Windred* where the values are expressed by the equation $R = k/P^n$ and the constants differ for increasing and decreasing pressures.

* G. Windred, J. Frank. Inst. **231**, 547 (1941).

D5. Low Angle Scattering of X-Rays. M. H. JELLINEK, *M. W. Kellogg Company* AND I. FANKUCHEN, *Polytechnic Institute of Brooklyn.*—Recently there has been increased interest in the low angle scattering of x-rays. All studies to date have used photographic methods for recording the scattered radiation. Where discrete maxima, whose location is to be determined, are concerned, this is no handicap but for some studies a continuous scattering must be studied over an intensity range of over 1000 to 1. We have used a Geiger counter and amplifier to measure this sort of low angle scattering. The intensities available are easily within the range of this instrument.

D6. Low Angle X-Ray Scattering. I. FANKUCHEN, *Polytechnic Institute of Brooklyn* AND M. H. JELLINEK, *M. W. Kellogg Company.*—In published work on low angle scattering, use has always been made of sharply defined beams of essentially monochromatic x-rays and long specimen-to-film distances. We have tried another entirely different method which seems to hold some promise. This utilizes two good single crystals, one as a monochromator and the other as an analyzer. The specimen is placed between the two crystals and a Geiger counter circuit is used to record the x-ray intensity as a function of the setting of the analyzing crystal. We have used the second crystal in the anti-parallel position and later as suggested to us by Dr. H. Friedman* in the parallel position.

* Naval Research Laboratory, Anacostia Station.

D7. Molecular Theory of the Scattering of Light in Fluids. BRUNO H. ZIMM, *Columbia University* (*Introduced by M. Goeppert-Mayer*).—A direct molecular theory of the scattering of light by fluids of isotropic molecules is developed utilizing recent advances in the statistical mechanics of condensed phases. The extent of the interference between the wave trains scattered from different molecules of the fluid is calculated with the aid of spatial molecular distribution functions. The integrals of these functions which are encountered are simply related to the concentration and volume derivatives of the free energy. The results are the same in first approximation as those of the continuous theory based on fluctuations originally proposed by Smoluchowski and Einstein. Higher approximations of the molecular theory are especially suitable for the study of critical opalescence and scattering by fluids consisting of very large molecules.

D8. The Continuum at the Mercury Arc Cathode. CHARLES G. SMITH. *Raytheon Manufacturing Company, Newton, Massachusetts.**—Micro-photographs of the arc spot on a quiescent mercury surface were secured by employing an arc gliding lengthwise over a long bead of mercury held between magnetic poles in a vacuum. The arc moved in the characteristic retrograde direction. The motion of the generated vapor being opposite to that of the arc, and the rapid progress of the cathode spot, prevented both the moving vapor and the arc pressure from disturbing the surface. The photographs show a well delineated source of light in the mercury surface or within 0.0005 cm of it, the intensity of which greatly exceeds that anywhere in the plasma. The continuous spectrum originates only at the cathode and doubtless comes from within the liquid from the electronically excited region that gives rise to the electron emission of the apparently cool mercury in accordance with the author's emission theory[1] of the mercury arc.

* Experiments performed at Harvard University.
[1] C. G. Smith, Phys. Rev. 62, 48 (1942).

D9. Motion of Electrolytes in a Magnetic Field. CLIFFORD E. SWARTZ, *University of Rochester* (*Introduced by W. van der Grinten*).—Investigation of the rotation of certain electrolytes ($FeCl_3$, HCl, $SnCl_3$) between and in contact with magnetic poles, has been carried out with many variations on the original Ehrenhaft experiments.[1] These variations do not differ fundamentally from the original experiments because the rotation and sense of rotation are unaffected by some inhomogeneity of the field. Ferromagnetic substances need not be used; the rotation is dependent on a chemical reaction. These rotations can be explained by assuming potential differences throughout the solution caused by the presence of the metal. This assumption has been verified by means of a special potentiometer and probe arrangement.

[1] F. Ehrenhaft, Bull. Am. Phys. Soc. 19, 3, 10 (June 23, 1944).

D10. The Measurement of Single Magnetic Charges and the Electrostatic Field around the Permanent Magnet. FELIX EHRENHAFT, *New York City.*—It has been observed in the microscopic dark field that in a magnetic condenser with horizontal homogeneous field established by an Alnico 5 permanent magnet test bodies of various substances fall vertically and undeflected in gases, or are deflected at various measurable angles to either condenser plate, their paths crossing the center line. Observing these falling bodies, the north or south magnetic charge of a single test body can be measured, applying the method of the author[1] in determining the positive or negative electric charge on a single particle. Applying a horizontal inhomogeneous axially symmetrical magnetic field, it has been observed that the force of charge qH exceeds the force of polarization so that even diamagnetic particles (e.g., Sb, Cu, C) move to the denser lines of force. A new fact added to past experience[2] is that the general path of a body bearing simultaneously electric and magnetic charges is a helix (spiral) in the constant field of a permanent magnet. The region of observation is shielded electrostatically. The electric field is created by the permanent magnet. Electricity and magnetism are aspects of a single phenomenon. Demonstrations will be provided elsewhere.

[1] F. Ehrenhaft, Ann. d. Wien. Akad. d. Wiss. No. VII (Mar. 4, 1909).
[2] F. Ehrenhaft, Nature 154, 426 (1944); Phys. Rev. 65, 287 (1944).

D11. Theoretical Implications of the Magnetic Current. GABRIEL KANE, *Manhattan College.*—The symmetrical form of Maxwell's field equations containing terms with magnetic charge and magnetic current is already in the literature.[1] The wave equations for electromagnetic waves traveling in a conducting medium may be deduced from these field equations. It is found that such wave equations contain terms in E and H in addition to the usual first and second derivatives of E and H with respect to time. The theoretical necessity of a magnetic current can be demonstrated by a process of reasoning similar to that which led Maxwell to the hypothesis of a displacement current. The nature of the magnetostatic potential will be discussed and the essential differences between the field of a permanent magnet and that of a steady current indicated.[2] The influence of magnetic current and magnetic charge on the concepts of the vector potential and the Hertzian vector will be considered.

[1] Page and Adams, *Electrodynamics* (D. Van Nostrand Company, New York, 1940), p. 160.
[2] Abraham and Becker, *Classical Electricity and Magnetism* (Blackie & Sons, London, 1943), p. 131.

D12. The Action of a Magnetic Field on Ferric Hydroxide. CHARLES B. REYNOLDS, *Hearst Radio, Inc., New York.*—A solution of ferric hydroxide was prepared for study of its action under the influence of a magnetic field. Upon application of a magnetic field the solution was observed to clear, a deposit appearing on the north pole of the electromagnet. The action was immediate and violent. It was found that reversal of the field reversed the deposit and that reversal could be accomplished three or four times. The composition of the deposit will be discussed. It was noted that the action was a function of the amount and concentration of the base used to form the hydroxide,[1] the nature of the base as well as the nature of the iron salt from which the hydroxide was precipitated.[2] It further appears that the ferric hydroxide is ferromagnetic since the action is also a function of magnetic field intensity.[3] The foregoing seems to offer some support to Ehrenhaft's claims as to the polar nature of magnetism.[4]

[1] R. Chevallier and S. Mathieu, Comptes rendus **206**, 1469, 1955 (1938).
[2] A. Quartaroli, Gazz. Chim. Ital. **64**, 161 (1934).
[3] P. Selwood, *Magnetochemistry* (Interscience Publishers, Inc., New York, 1943), p. 226.
[4] F. Ehrenhaft, Phys. Rev. **65**, 287 (1944).

FRIDAY MORNING AT 10:00

First Session of the Symposium on the Solid State

(A. J. DEMPSTER presiding)

Pupin 301

A1. Whither American Physics? F. SEITZ, *Carnegie Institute of Technology.* (20 min.)

A2. The Effect of High Hydrostatic Pressures on the Plastic Properties of Metals. P. W. BRIDGMAN, *Harvard University.* (40 min.)

A3. Amplitude Dependence of Internal Friction of Metals. T. A. READ, *Frankford Arsenal.* (30 min.)

A4. Virtues and Weaknesses of the Domain Concept. W. F. BROWN, JR., *Naval Ordnance Laboratory.* (30 min.)

A5. The Fracture Stresses in Steels. C. M. ZENER, *Watertown Arsenal.* (40 min.)

FRIDAY AFTERNOON AT 2:15

Second Session of the Symposium on the Solid State

(F. SEITZ presiding)

Pupin 301

B1. Mechanical Properties and Structure of Alloys. M. GENSAMER, *Carnegie Institute of Technology.* (40 min.)

B2. Some Aspects of the Theory of Ferromagnetism. J. H. VAN VLECK, *Harvard University.* (40 min.)

B3. Creep of Metals as a Reaction Velocity. S. DUSHMAN, *General Electric Company.* (30 min.)

B4. The Statistical Problem in Cooperative Phenomena. G. H. WANNIER, *University of Iowa.* (30 min.)

FRIDAY AFTERNOON AT 2:15

Pupin 428

Contributed Papers

E1. The Application of Network Analysis to Some Electron Optical Problems. ALBERT F. PREBUS AND IGNACE ZLOTOWSKI, *Ohio State University and* GABRIEL KRON, *General Electric Company.*—By suitable correlation of the variables, the trajectory equation

$$\phi(z)\cdot\frac{d^2r}{dz^2}+\tfrac{1}{2}\phi'(z)\cdot\frac{dr}{dz}+\tfrac{1}{4}\left[\phi''(z)+\frac{a}{2mc^2}H^2(z)\right]\cdot r=0$$

of an electron lens may be identified with the differential equation describing the dependence of the voltage distribution upon the impedance characteristics of a simple type of ideal inhomogeneous transmission line. By choosing the specific impedances as functions of the independent variable z [distance along the axis of symmetry] and the parameters $H(z)$ and $\phi(z)$ [z component of the magnetic field and electrostatic potential, respectively, on the axis], the values of the dependent variable $r(z)$ [radial displacement of the electron] correspond to voltages along the line. The equivalent network provides a rapid means of obtaining accurate numerical solutions of the trajectory equation. Application of this method is demonstrated for the case of a strong magnetic lens by comparing the results with the exact solutions given by Glaser.[1] The usefulness of a two-dimensional network for determining the electrode configuration of an electrostatic lens from a given axial potential distribution is discussed.

[1] W. Glaser, Zeits. f. Physik. **117**, 285 (1941).

E2. Capture Cross Section of Hydrogen for Slow Neutrons. LEROY G. SCHULZ* AND M. GOLDHABER, *University of Illinois.*—The capture cross section of hydrogen for slow neutrons is of great theoretical interest. The most accurate experimental method for its determination is probably that devised by Frisch, v. Halban, and Koch,[1] who determined this cross section by measuring the ratio of the capture cross section of boron to that of hydrogen. As later measurements made by various other methods did not agree well with their result, it seemed worth while to repeat their experiment with some modifications and increased accuracy. We find for the ratio of the capture cross section of B to that of H the value 1954 ± 24, in good agreement with the value 1940 ± 100, obtained by Frisch, v. Halban, and Koch. If we assume for B a capture cross section of 600×10^{-24} cm^2 we obtain for H a capture cross section of 0.307×10^{-24} cm^2, which should be compared with the theoretical value of 0.302×10^{-24} cm^2 given by Rarita and Schwinger.[2]

* Now at the Haskins Laboratories, New York, New York.
[1] O. R. Frisch, H. v. Halban, and J. Koch, Proc. Danish Acad. **15**, 10 (1938).
[2] W. Rarita and J. Schwinger, Phys. Rev. **59**, 436 (1941).

E3. Evidence for the Production of a Non-Ionizing Radiation other than Neutrons and Gamma-Rays by 10-Mev Deuterons. GERHART GROETZINGER, P. GERALD KRUGER, AND LLOYD SMITH, *University of Illinois.*—An arrangement of two Geiger-Mueller counters in coincidence shielded by various thicknesses of lead up to 19-cm thickness has been used to investigate non-ionizing radiations produced by a cyclotron. The cyclotron was enclosed by watertanks of 120-cm thickness. Electrons have been found of energies greater than 5 Mev; their number as a function of the lead thickness indicates that they are produced by a radiation far more penetrating than gamma-rays. The water in the tanks close to the counters was later saturated with boric acid and the leadhouse surrounded by enough cadmium and paraffin to eliminate a large fraction of both fast and slow neutrons, which might have penetrated the watertanks. No appreciable effect on the counting rate was noticed. Various external targets (P, Mn, Sb, and W) were used in the cyclotron. A slight dependence of the number of counts on the target material was observed.

E4. K to L Conversion Ratio. I. S. LOWEN, *New York University.*—The relative proportions of electric and magnetic-multipole radiation occurring in nuclear transitions may be determined with the aid of the K to L conversion ratio and the absolute values of the internal conversion coefficients.[1,2] Theoretical calculations which have served as the basis for such evaluations have been presented in the case of light nuclei ($Z<50$) for two circumstances: (a) for the electric multipole case using Schrodinger non-relativistic theory, (b) for the magnetic multipole case such that the binding energy of the ejected electron may be neglected.[1,3] For those energies such that the assumption of negligible binding energy is not a good one, it is desirable to have estimates for the K to L ratio for magnetic multipole radiation valid over the same range of energies as (a). Such estimates have been obtained for nuclei with $Z<50$ with the aid of the Pauli theory and will be presented in the form of curves suited for the estimation of relative proportions of magnetic and electric multipole radiation in those cases where the binding energy of the electron may not be neglected.

[1] Hebb and Nelson, Phys. Rev. **58**, 486 (1940).
[2] A. C. Helmholz, Phys. Rev. **60**, 415 (1941).
[3] Dancoff and Morrison, Phys. Rev. **55**, 122 (1939).

E5. Magnetic Multipole Conversion for K Electrons. G. GOERTZEL AND I. S. LOWEN, *New York University.*—Formulae for internal conversion coefficients for K electrons in light nuclei have been derived for two different approximations: (a) Non-relativistic using Schrodinger hydrogen-like wave functions;[1,2] (b) relativistic but restricted to low binding energies.[2] In approximation (a), where the spin of the electron is neglected, the magnetic multipole conversion vanishes as a consequence of the parity selec-

tion rules.[2] However, when the electron spin is taken into account through the use of the Pauli theory, the interaction of the magnetic moment of the electron with the magnetic field of the radiation leads to a finite non-vanishing conversion coefficient for 2^l magnetic multipole radiation given by

$$\beta_l^k = 16\alpha \frac{l}{2l+1}\left[\Gamma(l+\tfrac{3}{2})\right]^2\left(\frac{2}{\nu}\right)^l \frac{n^4}{(1+n^2)^{l-1}} \times \frac{\left[(l+2)(1+n^2)^{l-1}\exp(-2n\cot^{-1}n) - V_l^1\right]^2}{\prod_{s=1}^{l+1}(s^2+n^2)(1-e^{-2\pi n})}$$

where

$$V_l' = \frac{4^l \prod_{s=1}^{l+1}(s^2+n^2)\, F\left(2, -1-2l, 1-l-in; \frac{1-in}{2}\right)}{(1+n^2)(2l+1)!(l+1+in)(l+in)}$$

all other symbols having the same definitions as in Dancoff and Morrison.[3] This result is restricted to elements with $Z<50$ and γ-ray energies not greater than about 3×10^5 volts. Comparisons will be given between the predictions of this calculation and those for the corresponding electric case.

[1] M. H. Hebb and G. E. Uhlenbeck, Physica **5**, 605 (1938).
[2] S. M. Dancoff and P. Morrison, Phys. Rev. **55**, 122 (1939).

E6. Charge Neutralization by Atmospheric Ions. W. G. POLLARD, *University of Tennessee.**—The neutralization of an insulated, charged, conducting object immersed in a neutral ion atmosphere in which the mobilities of both ions are constant and independent of the field is considered. The object becomes surrounded by an opposite ion sheath whose volume increases exponentially with time to a limiting value just sufficient to have contained a charge at the original plasma density equal and opposite to that initially carried by the object. The total charge in the sheath increases to a maximum and then drops to zero. The sum of the sheath and object charges decays exponentially but individually they are more complex functions of time. In the plasma the density of both kinds of ion remains constant at its initial value and the field is that which would be produced by the object if it carried the sheath charge in addition to its own. A general solution for the field and charge density in the sheath as functions of position and time which join continuously with the plasma values over the moving sheath boundary is obtained. The character of this solution will be discussed at the meeting.

* This work was done for The Chicopee Manufacturing Corporation, Chicopee Falls, Massachusetts.

FRIDAY AFTERNOON AT 4:00

Pupin 428

Invited Papers

(HARVEY FLETCHER presiding)

F1. Double Bragg Reflections in a Single Crystal. C. J. DAVISSON AND F. E. HAWORTH, *Bell Telephone Laboratories.* (20 min.)

F2. Catalysis: A Challenge to the Physicist. O. BEECK, *Shell Development Company.* (30 min.)

FRIDAY AFTERNOON AT 5:00

Pupin 301

Discussion of the Proposal of a Division of the Physics of the Solid State

(K. K. DARROW presiding)

SATURDAY MORNING AT 10:00

McMillin Theatre

Business Session of the American Physical Society

SATURDAY MORNING AT 10:40

McMillin Theatre

Retiring Presidential Address of the American Physical Society

"Twenty-five Years of Mass-Spectroscopy." A. J. DEMPSTER, *University of Chicago.*

Presentation of the Oersted Medal of the American Association of Physics Teachers

Fourth Richtmyer Memorial Lecture of the American Association of Physics Teachers

I. I. RABI, *Columbia University*

SATURDAY AFTERNOON AT 2:15

Third Session of the Symposium on the Solid State

(R. SMOLUCHOWSKI presiding)

Pupin 301

C1. Effect of Small Stresses on Magnetic Properties. R. M. BOZORTH, *Bell Telephone Laboratories.* (30 min.)

C2. Ferromagnetic Impurities in Solids. F. W. CONSTANT, *Duke University.* (20 min.)

C3. Magnetization of Gold-Iron and Gold-Nickel Alloys. A. R. KAUFMANN, S. T. PAN, AND J. R. CLARK, *Massachusetts Institute of Technology.* (30 min.)

C4. A Recording Fluxmeter of High Accuracy and Sensitivity. P. P. CIOFFI, *Bell Telephone Laboratories.* (20 min.)

TO BE READ BY TITLE

T1. Computation of Electron Trajectories in Electrostatic Lenses of Rotational and Plane Symmetry. IGNACE ZLOTOWSKI AND ALBERT F. PREBUS, *Ohio State University.*—Network analysis is applied to the specification of the cardinal points of electrostatic lenses. The advantages of this method of numerical integration of the lens trajectory equation are shown by comparing it with other methods currently in use. The requisite axial potential distributions of the lenses are obtained from accurate electrolytic trough measurements. Data of practical value are provided which show the dependence of optical properties on electrode parameters of some familiar types of electrostatic lenses. The inverse problem of determining the axial potential distributions corresponding to a given trajectory is investigated.

T2. Loss of Weight by Rotation. CHARLES T. DOZIER, *San Diego.*—From consideration of the earth as an astronomical body with sidereal period of rotation about its polar axis, the weight of a mass at rest on the earth's equator is the resultant of the full gravitational attractive force between mass and earth diminished by the centrifugal force acting on the mass. If the mass has horizontal translation along the equator, the gravitational attractive force, so far as is known, will remain constant, but the centrifugal force acting on the mass will increase during easterly and decrease during westerly translation. A forty-thousand-pound airplane in level flight at three hundred miles per hour along the equator near sea level is 160 pounds lighter in easterly than in westerly flight. Now consider a mass rotating about a vertical axis through its center, fixed in longitude and altitude. The easterly-moving half of the mass loses weight and simultaneously the westerly-moving half gains in weight, within limits, but the loss exceeds the gain, without limits. The net loss in weight is proportional to the square of the angular velocity of rotation of the mass about its axis. Appropriate factors are introduced for other latitudes and altitudes.

T3. Gravitational Ground Speed Indicator. CHARLES T. DOZIER, *San Diego.*—Reference is made to the current abstract, "Loss of weight by rotation," by this author. The effect of torque developed by the difference in weight of the easterly- and westerly-moving halves of a mass rotating about a vertical axis through its center and mounted in an airplane is found to be proportional to the east-west component of level flight ground speed of the plane. The mass rotates at constant angular velocity. Two such masses rotating in opposite directions are connected by linkage in such a manner as to indicate the torque and thus the east-west component of ground speed directly on a calibrated scale. Latitude and altitude factors are introduced. The full ground speed of the plane is derived by vector methods from this component and the known direction of flight. Patent rights are assigned by the author to Consolidated Vultee Aircraft Corporation, San Diego, California.

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(To be sent to Karl K. Darrow, American Physical Society, Columbia University, New York 27, New York)

I EXPECT to attend the dinner of the American Physical Society at the Men's Faculty Club of Columbia University, 400 West 117th Street, at six o'clock on Friday evening, January 19, 1945. My party will consist of ___ persons.